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Animal and Plant Health Inspection Service

Plant Protection and Quarantine Programs

Results of a Three-Year Cotton Pest Management Program in the Hill Section of Mississippi

by

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ABSTRACT

A Federally funded cotton insect pest management program was conducted in Mississippi in 1972, 1973, and 1974. Trained cotton scouts made weekly population assessments of all cooperating producers' fields from early June until late August each year. The four suppression techniques employed by the producers reduced boll weevils from a seasonal mean infestation of 10.8 percent in 1972 to 4.5 percent in 1974. The program initially involved 109 producers and 16,759 acres of cotton but was expanded to 610 producers and 77,950 acres in 1974.

INTRODUCTION

Federally funded cotton pest management programs were initiated in 14 cotton-producing States in 1972. Each of these programs was organized and conducted differently as a result of local cultural practices, pest species, and so forth. All programs were funded for 3 years by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS) Plant Protection and Quarantine Programs. All shared a common objective to demonstrate that the best approach to pest control is to obtain accurate pest population assessments and to utilize a variety of control strategies to maintain sub-economic pest infestations.

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Carruth and Moore (4)⁵ reported the results of a program conducted in Arizona. Black and Burton (2) described the California project, and Barnes and others (1974) discussed the Arkansas program. Information presented herein represents the findings of a program which originated in two Mississippi counties in 1972 and was expanded into 16 additional counties in 1974.

The arthropod pest complex of cotton grown in the north-central hill section of Mississippi consists of several species, but the boll weevil, *Anthonomus grandis* Boheman, is considered the primary pest. Other arthropods such as the bollworm, *Heliothis zea* (Boddie); tobacco budworm, *H. virescens* (Fabricus); spider mite, *Tetranychus urticae* Koch; and cotton aphid, *Aphis gossypii* Glover are considered secondary pests because they frequently increase to economic levels following insecticide applications to control the boll weevil.

Excessive amounts of insecticides have been used by many producers in this area. Rather than examine their fields to determine the presence of insect infestations, they apply insecticides on an automatic schedule. This practice has increased control costs, increased the probability that insect resistance may occur, added to the pesticide load applied to the environment, and necessitated the control of secondary pests.

Cropping practices in the program area differ considerably from those in other cotton-growing areas, such as the irrigated cotton in the southwestern United States or even the large plantations of the Mississippi Delta. The average acreage per producer in 1972 was 140, with the fields averaging about 10 acres in size. Most fields were completely surrounded by large trees which made proper aerial application of insecticides extremely difficult. This type of terrain, with its excellent overwintering quarters combined with the hot, humid summers and mild winters, contributed to the development of economically devastating boll weevil populations.

PROGRAM ORGANIZATION

In March 1972, a cooperative agreement between the Animal and Plant Health Inspection Service, USDA, the Extension Service, the Mississippi Cooperative Extension Service, the Mississippi Department of Agriculture, and the Mississippi Agricultural and Forestry Experiment Station was initiated. The purpose of this agreement was to provide funds, technical supervision, and organization for a cooperative, areawide, producer-oriented cotton pest management program. A State steering committee comprised of 20 local leaders in agricultural research, regulatory agencies, and agrichemical industry reviewed and offered a critical appraisal of the program each year. Day to day activities were coordinated and executed by personnel employed by the Mississippi Cooperative Extension Service, and APHIS. Participating growers formed a nonprofit corporation. A board of directors elected by the corporation members was responsible for hiring scouts (field checkers) and providing suggestions on program improvement.

PROGRAM IMPLEMENTATION

Through organized efforts of the local county Extension agents, all cotton producers were notified in April 1972 that a scouting program would be available to them at a cost of \$1.25 per acre. The program would consist of systematic weekly surveys of each field by trained scouts and subsequent control recommendations by program personnel, based on insect population counts made by the scouts. Compliance with the control recommendations was not mandatory.

Scouts made weekly checks of all cooperating producers' fields from early June through late August. Each scout was responsible for checking from 900 to 1200 acres of cotton each week. Data on pest and beneficial insect populations, crop phenology, and agronomic practices were recorded in triplicate on carbonized data forms and returned nightly to the program office. One copy of each form was then mailed to the computing center at Mississippi State University. These data were used to establish a computerized data base for historical purposes as well as to provide a revised summary of insect trends in each field, community, and county each week. These computer summaries were relied on heavily by project personnel to prepare weekly newsletters and radio programs.

Immediately after a field was checked, the scouts prepared a simplified farmer report on the current insect infestation. Within 24 hours after receiving a scout's report, each farmer was contacted by project personnel and control recommendations were discussed. This personal contact with the growers was considered to be the most critical step in the successful operation of the program.

⁵Underscored numbers in parentheses refer to literature citations listed at the end of the report.

The 1973 program was basically the same as that of the first year, and only one major change was incorporated in the 1974 program. In 1972 and 1973, each scout worked in a specific area of a county. Scouts were therefore scattered throughout each county so that it was necessary for the scout supervisor to drive over the entire county several times each day in order to assist scouts and contact producers. In 1974, all scouts started in the same section of the county at the beginning of the week and moved across the county working together in the same general area as the week progressed. As a result, the scout supervisor could more readily locate scouts and contact producers.

PEST POPULATIONS

The boll weevil is the primary pest on cotton in this area; thus the major emphasis of the control program was directed against this insect. The suppression techniques employed by the producers included the following:

1. Early season (pinhead square) insecticide applications to eliminate overwintering weevils (5, 8, 13).
2. Reliance upon scouting reports to determine if pest population levels warrant chemical control measures (12).
3. Utilization of optimum insecticide rates and proper timing of applications (12).
4. Boll weevil diapause control (3).

Data on boll weevil infestations are summarized in table 1. The 1972 infestation level far exceeded those of succeeding years, and can be explained in the following manner: (1) Prior to the fall of 1972, organized communitywide boll weevil diapause programs had not been conducted in the project area. The resulting high populations of overwintering weevils were able to emerge and produce correspondingly high subsequent populations. (2) Grower confidence in the program was not fully established during the first season; thus some producers failed to respond to control recommendations in a timely manner in order to prevent population buildup.

Table 1.—Summary of Boll Weevil and Bollworm Infestations, Mississippi Cotton Insect Pest Management Project, 1972-1974

Week ending	Infestation Level ¹					
	X percent Boll Weevil damaged squares			X percent Bollworms per 100 cotton terminals		
	1972	1973	1974	1972	1973	1974
June 7	—	0.0	0.0	—	0.0	0.0
June 14	0.0	0.0	0.0	0.0	0.0	0.0
June 22	3.4	0.0	0.2	0.2	0.0	0.0
June 28	7.2	0.1	1.4	0.4	0.0	0.0
July 6	11.0	2.9	2.5	0.4	0.1	0.1
July 12	9.5	4.7	2.2	0.2	0.3	0.3
July 19	6.9	5.7	4.7	0.2	0.6	0.3
July 26	9.6	7.7	6.3	0.2	0.6	0.3
August 2	16.0	7.8	7.1	0.3	0.7	1.3
August 9	16.3	8.2	6.2	0.9	1.5	1.2
August 16	17.3	10.0	10.8	0.8	0.6	2.9
August 23	21.4	13.3	13.3	1.1	1.0	3.9
Average for season	10.8	5.0	4.5	.4	.5	.8

¹ Based on observation of 1076, 1311 and 897 fields per week in 1972, 1973 and 1974, respectively.

In the fall of 1972, approximately 12,000 of the 25,587 total acres in the two-county area received one application of methyl parathion or azinphosmethyl for control of diapausing boll weevils. An additional 6,000 acres received two applications. Participation in the diapause program was on a voluntary basis and the method, as well as the exact date of application, was at the discretion of the producers. Results of this effort combined with the increased grower confidence in the program and cooperation with program personnel were evident by the lower weevil population noted in 1973. As shown in table 1, the seasonal mean infestation was 10.78 percent in 1972 as compared to 5.03 percent in 1973.

In the fall of 1973, diapause control was not promoted in communities where complete participation of all producers could not be obtained. In communities where full participation could be obtained, farmers signed a compliance agreement granting advance approval for local aerial applicators to treat their acreage on a specified date. Approximately 6,500 acres out of a total of 19,000 acres in the two-county area received four diapause applications and approximately 13,000 acres received one application. The use of a compliance agreement proved to be a very effective means of insuring that grower participation would be achieved. Past experience had indicated that many producers would initially agree to participate in a voluntary program. However, due to the rushed pace of the harvest season combined with the thought of additional diapause expense, some producers later failed to make the additional diapause applications. This greatly reduced the effectiveness of the overall program since maximum effect is achieved only when diapause control is conducted on a communitywide basis (12).

Leggett traps (11) baited with grandlure (9) were used to evaluate the 1973 diapause program in the spring of 1974. Twenty fields in the diapause area and 20 fields outside the area (no organized program) were randomly selected as survey sites. Five traps were placed around the periphery of each field and baited at 1- to 2-week intervals, depending on longevity of the pheromone formulation in use. Traps were checked weekly from May 1 until July 1 and the number of weevils captured was recorded. Approximately three times as many weevils were captured outside the diapause area as were captured within the area, thereby demonstrating the effects of the fall diapause program.

The seasonal mean boll weevils infestation also reflected the cumulative effects of the prior year's diapause efforts. As shown in table 1, the mean for 1974 was 4.56 percent as compared to 5.03 percent for 1973 and 10.78 percent for 1972.

One application of a phosphate insecticide (azinphosmethyl or methyl parathion) applied within 7 days prior to the appearance of the first square of sufficient size for boll weevil reproduction has been termed a pinhead square application. The intent of this insecticide application is to eliminate overwintering boll weevils which have moved into the young cotton. Properly timed early season or pinhead square applications may reduce the overwintered weevil population to the extent that control of the F_1 generation is unnecessary, thereby eliminating two to three insecticide applications (5, 6, 7). Although this procedure is probably not as effective as three or four diapause applications in the fall, most producers in this particular program demonstrated far more confidence in the pinhead square application since it was applied to the current year's crop. Grower acceptance of this practice has made it one of the main elements of this program, and was the greatest single factor in the reduction of insecticide usage.

Table 1 also summarizes data on bollworm (*Heliothis* spp.) infestations. *Heliothis* populations in the hill section of Mississippi are usually light when compared to boll weevil populations. All producers were able to withstand the first and second bollworm generations each year without resorting to chemical control measures. Third generation bollworms did cause problems in a small percentage of the fields, but most producers were able to withstand this generation also without resorting to chemical control. Most fields did develop economic infestations of bollworms in late August 1974. A survey conducted on approximately 3,000 acres at this time indicated that 91 percent of the bollworms collected were *H. virescens*. However, this was to be expected since insecticides were being applied for bollworm control and *H. zea* are more easily controlled than *H. virescens* (10). It has also been observed (Harris, unpublished data) that *H. virescens* populations in general are heavier in late August than *H. zea*. These two factors aid in explaining the high incidence of *H. virescens* populations noted in our survey. Destruction by this pest has slowly increased over the years (Young and Brazzel, 1964) and in some areas of the State it is now considered the primary pest on cotton.

PROJECT PARAMETERS

Table 2 summarizes a number of program parameters including the number of acres, number of producers, and cost per acre on a yearly basis. Excessive rainfall in the spring of 1973 prevented many producers from planting their desired acreage. As a result, a decrease in both the number of producers and total acreage in the 1973 program was noted. However, by 1974, the acreage had increased to approximately 4.5 times that of 1972, clearly indicative of grower opinion of this project. Per-acre cost for the scouting program ranged from \$1.65 an acre in 1972 to \$1.75 per acre in 1974.

These results clearly demonstrate the operational feasibility of conducting this type of program in the hill section of Mississippi. Experience and expertise gained in this pilot project will enable project personnel to develop and expand the program into adjoining counties which do not presently have an organized cotton insect pest management program.

Table 2.—Project parameters for Mississippi cotton pest management project, 1972-1974

Parameter	1972	1973	1974
Number of acres in program	16,759	13,824	77,950
Number of producers	109	97	610
Number of counties in program	2	2	18
Average cost per acre for scouts salaries, travel, etc. ¹	\$1.65	\$1.73	\$1.67
Average number of acres per scout per week ²	1,047	1,063	1,163
Average number of in-season insecticide applications per acre ²	—	9.8	10.0
Average per acre yields of lint cotton ³	588	615	480
Per acre charge to participating producers	\$1.25	\$1.25	\$1.50 - \$1.75

¹ Does not include cost of supervisor but this figure was determined using only those counties which had supervisors.

² Pilot project area only.

³ Based on a random sample of 97, 59, and 10 percent of the producers for 1972, 1973 and 1974 respectively.

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